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INDUSTRIAL ENGINEERING
EDUCATION AND TRAINING

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R RESEARCH
E AND
A ENGINEERING
P FOR
S AUTOMATION
AND
PRODUCTIVITY
IN
SHIPBUILDING

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San Diego, California

MINICOMPUTER APPLICATIONS FOR LONG RANGE PLANNING

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Mr. Eddy is a graduate of San Diego State University with a degree in applied physics. His past experience includes systems analysis, cost estimating and analysis, and structures engineering.

SEVERAL YEARS AGO WE, THE PLANNING AND SCHEDULING DEPARTMENT OF NATIONAL STEEL AND SHIPBUILDING COMPANY, DECIDED TO AUTOMATE A PROCEDURE FOR ASSESSING THE SHIPYARD RESOURCES REQUIRED TO SUPPORT POTENTIAL NEW BUSINESS, THE PROCEDURE CENTERED AROUND THE USE OF "S CURVES" WHICH WERE USED TO SPREAD ROUGH-CUT ESTIMATED HOURS FOR THE POTENTIAL NEW BUSINESS OVER, THE BUILDING SPAN DURING THE ANTICIPATED TIME FRAME IN WHICH FACILITIES WOULD BE AVAILABLE, DATA WAS PRODUCED AT THE YARD LEVEL AND FOR VARIOUS CRITICAL TRADES FOR BOTH PREVIOUSLY COMMITTED WORK AND THE ANTICIPATED NEW BUSINESS, THE DYNAMICS OF THE MARKET PLACE, COUPLED WITH A MANUAL SYSTEM MADE IT DIFFICULT TO SUPPORT MANAGEMENT WITH THIS ESSENTIAL INFORMATION IN AN EXPEDIENT MANNER,

AT THAT POINT IN TIME WE TOOK DELIVERY OF A TEKTRONIX MODEL 4051 MINICOMPUTER, IT WAS PRIMARILY SLATED FOR PERFORMING LEAST SQUARES BEST FIT REGRESSIONS WHICH WERE TO BE USED IN MAKING ESTIMATES AT COMPLETION, THE USE OF THIS MINICOMPUTER AS A TOOL GAINED RAPID ACCEPTANCE WITHIN THE GROUP AND WE EAGERLY SOUGHT OTHER APPLICATIONS FOR ITS USE, THE "WHAT-IF" GAMES, AS WE CALLED THEM, SEEM LIKE THE IDEAL CANDIDATE,

IF YOU WOULD LIKE TO TAKE ADVANTAGE OF THE LONG RANGE PLANNING TECHNIQUE WHICH I'M ABOUT TO EXPLAIN TO YOU, YOU WILL HAVE TO TAKE INTO ACCOUNT THE FOLLOWING CONSIDERATIONS AS SHOWN ON FIGURE 1. WHILE WE CHOSE A TEKTRONIX MODEL FOR OUR MINICOMPUTER, THERE ARE MANY OTHER EQUALLY WELL SUITED COMPUTERS THAT CAN GET THE JOB DONE, THE TEKTRONIX MODEL 4051 IS A GRAPHIC TERMINAL WHICH HAS 32K BYTES OF PROGRAMABLE CORE, A TAPE DRIVE, AND AN AUXILIARY HARDCOPY UNIT,

LONG RANGE PLANNING
CONSIDERATIONS

HARDWARE

- o **TEKTRONIX MDEL 4051**
- o **GRAPHIC TERMINAL**
- o **TAPE DRIVE**
- o **HARDCOPY UNIT**

SOFTWARE

- o **PROGRAMMING**
- o **LANGUAGE**
- o **STATISTICAL PACKAGE**

DATA

- o **COLLECT**
- o **NORMALIZE**
- o **POLYMNIAL CURVE FIT**
- o **FAMILY OF CURVES**
- o **CONSTRUCT MATRIX**

STATUS

- o **PROGRESS**
- o **ESTIMATE TO COMPLETE**
- o **MDEL CURVE SELECTION**
- o **KEY DATES**
- o **BUILDING POSITION**

Figure 1.

A GREAT DEAL OF CONSIDERATION MUST BE GIVEN TO THE SOFTWARE WHICH MUST BE DEVELOPED, THE COMPUTER BY ITSELF IS A DORMANT TOOL UNTIL IT IS PROGRAMED, THEREFORE, YOU OR YOUR PEOPLE WILL HAVE TO LEARN TO WRITE SIMPLE PROGRAMS, I WOULD SUGGEST THAT YOU STICK TO THE BASIC PROGRAMMING LANGUAGE SINCE IT IS INTERPRETIVE AND VERY EASY TO USE,

THE SOURCE DATA MUST BE AVAILABLE, , THIS HISTORICAL DATA COULD BE IN SEVERAL FORMS SUCH AS MEN OR HOURS PER DAY OR WEEK OR MONTH, IT MUST ACCURATELY REPRESENT HOW A SHIP WAS CONSTRUCTED OVER TIME, THE NEXT STEP IS TO NORMALIZE THE COLLECTED DATA BY REDUCING THE DEPENDENT AND INDEPENDENT VARIABLES TO SPREADING 100% OF THE RESOURCE OVER 100% OF THE TIME RESPECTIVELY, THE NORMALIZED DATA IS THEN ENTERED INTO THE COMPUTER AS A PAIRED XY DATA POINTS FILE WHERE IT IS RUN AGAINST A LEAST SQUARES BEST FIT POLYNOMIAL CURVE STATISTICAL PROGRAM UNTIL AN EQUATION OF SUITABLE FIT IS OBTAINED, THE PROCESS IS REPEATED FOR DIFFERENT TYPES OF SHIPS THAT YOU HAVE BUILT UNTIL YOU HAVE CONSTRUCTED A FAMILY OF MDEL CURVES, THESE CURVES COULD BE IN EITHER THE CUMULATIVE (REF. FIGURE 2) OR THE INCREMENTAL (REF. FIGURE 3) FORM

ONCE THE "MDEL CURVE" LIBRARY HAS BEEN ESTABLISHED WE CAN BUILD A MATRIX WHICH WILL SERVE AS THE INPUT FILE FOR THE SPREAD ROUTINE PROGRAM, THE ESSENCE OF THIS MATRIX WILL BE TO CONVEY TO THE PROGRAM THE FOLLOWING INFORMATION: PER CENT COMPLETE, ESTIMATE TO COMPLETE, CURVE MDEL SELECTION, KEY DATES, ALONG WITH THE AVAILABLE BUILDING POSITION FOR EACH HULL,

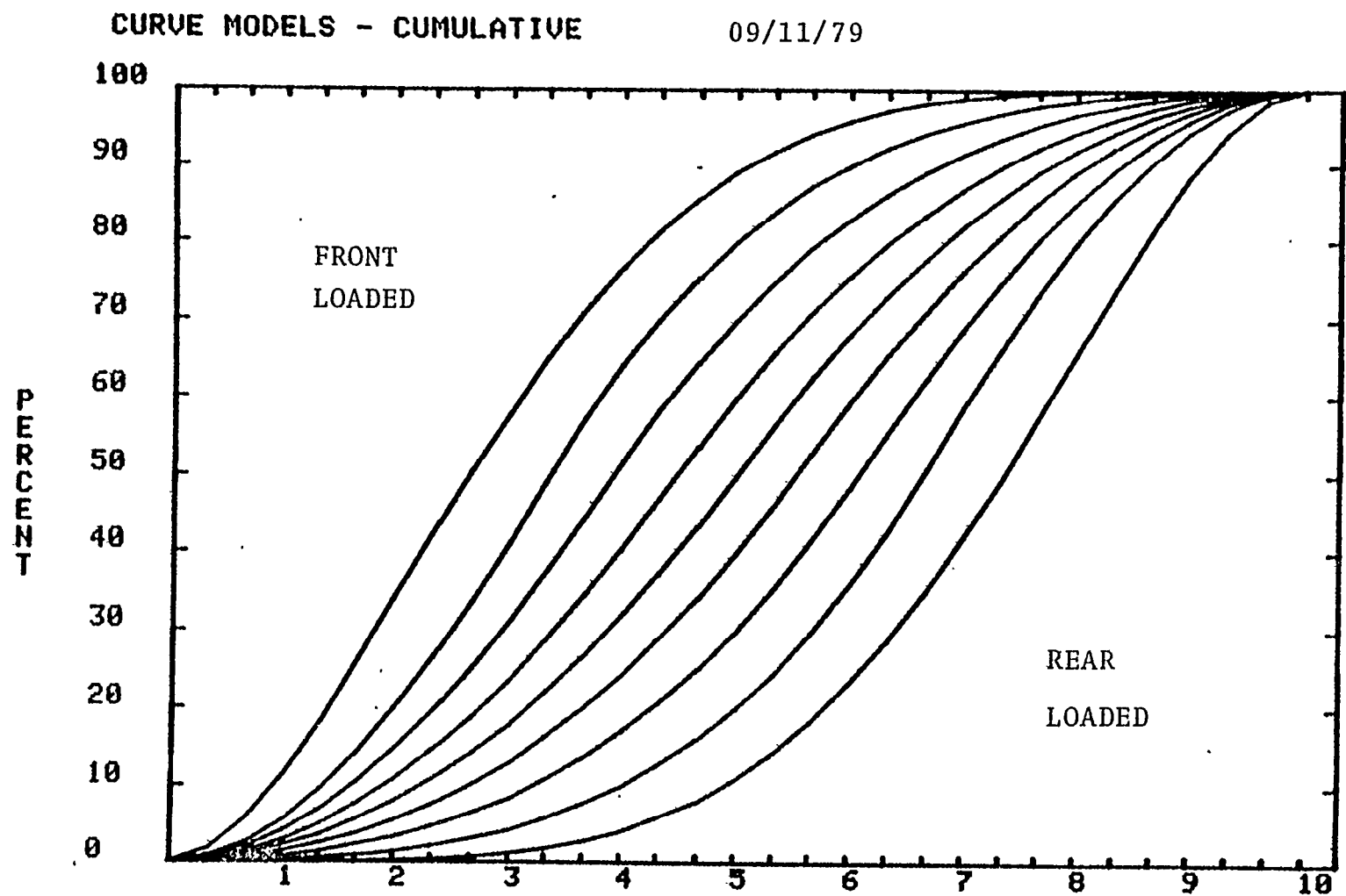


Figure 2.

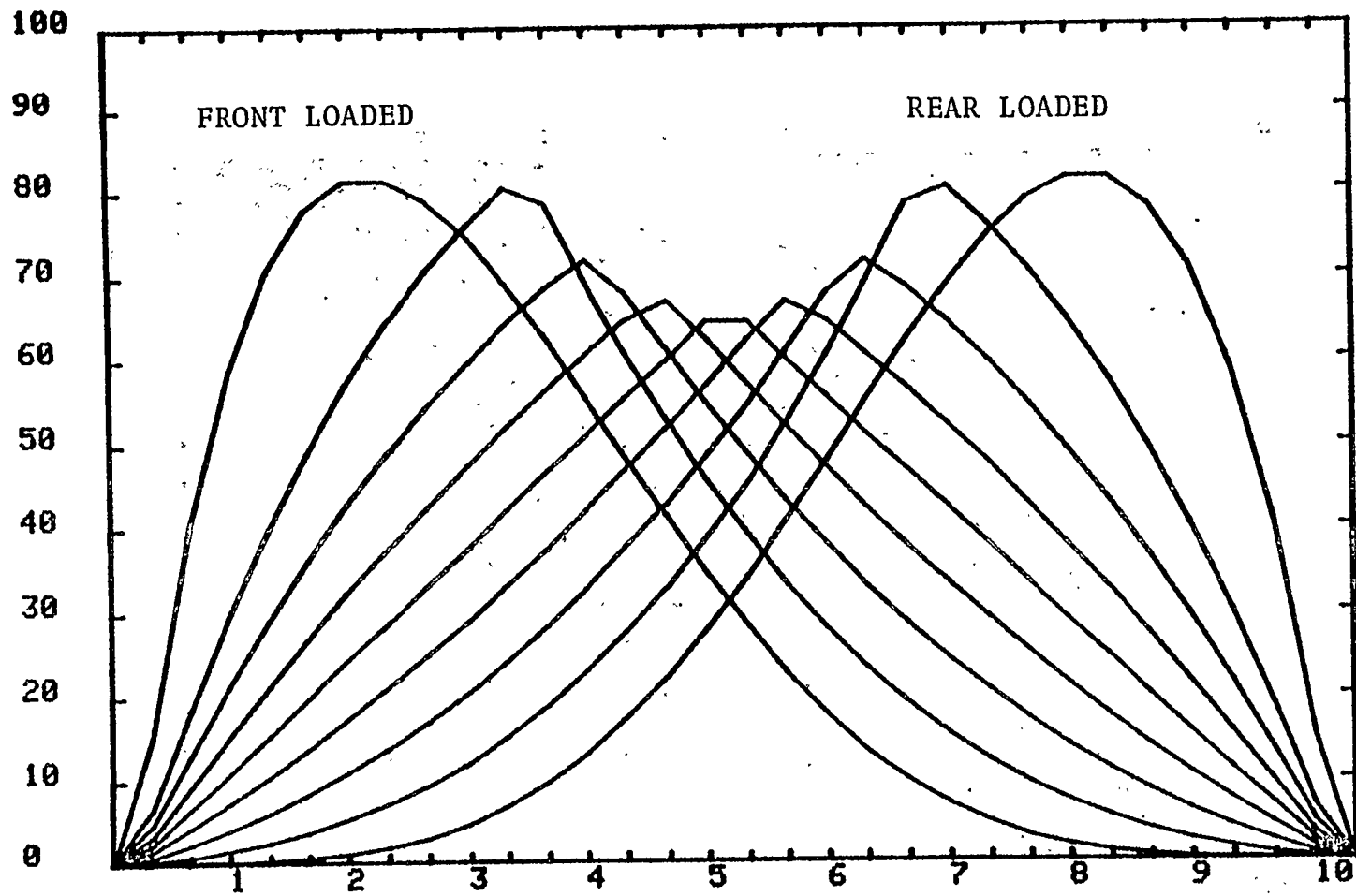


Figure 3.

THE PROGRAM IS THEN EXECUTED YIELDING RESULTS DEPICTED IN FIGURES 4, 5, AND 6. FIGURE 4 IS THE SCHEDULE OF SHIP DELIVERIES WHICH DISPLAYS THE KEY DATES (I.E. START OF CONSTRUCTION, KEEL, LAUNCH AND DELIVERY) FOR PREVIOUSLY COMMITTED WORK AND THE ANTICIPATED NEW BUSINESS (I.E. ONE BARGE), FIGURE 5 DEPICTS HOW THE BUILDING WAYS WILL BE UTILIZED, FINALLY, THE MANPOWER REQUIREMENTS ASSOCIATED WITH FIGURE 4 ARE SHOWN ON FIGURE 6 FOR BOTH FIRM AND THE POTENTIAL NEW BUSINESS, MANPOWER DISPLAYS MAY ALSO BE PRODUCED FOR CRITICAL TRADES, WORK CENTERS, OR DEPARTMENTS,

IN SUMMARY, I WOULD LIKE TO RELATE TO YOU THAT WE AT NASSCO HAVE PRODUCED TIMELY AND COST EFFECTIVE INFORMATION FOR LONG RANGE PLANNING USING THIS TECHNIQUE, WE FEEL IT IS ESSENTIAL THAT OUR SHIPYARD, FINDING OURSELVES IN A DYNAMIC MARKET PLACE, BE ABLE TO MAKE RAPID, YET ACCURATE ASSESSMENT ON THE RESOURCES REQUIRED TO SUPPORT ANTICIPATED NEW BUSINESS (I.E. SOLICITED OR UNSOLICITED),

A B C SHIPBUILDING
AND DRYDOCK CO.

SCHEDULE OF
SHIP DELIVERIES

DATE: 09/11/79

LEGEND:

WAYS
WATER



REAPS PRESENTATION

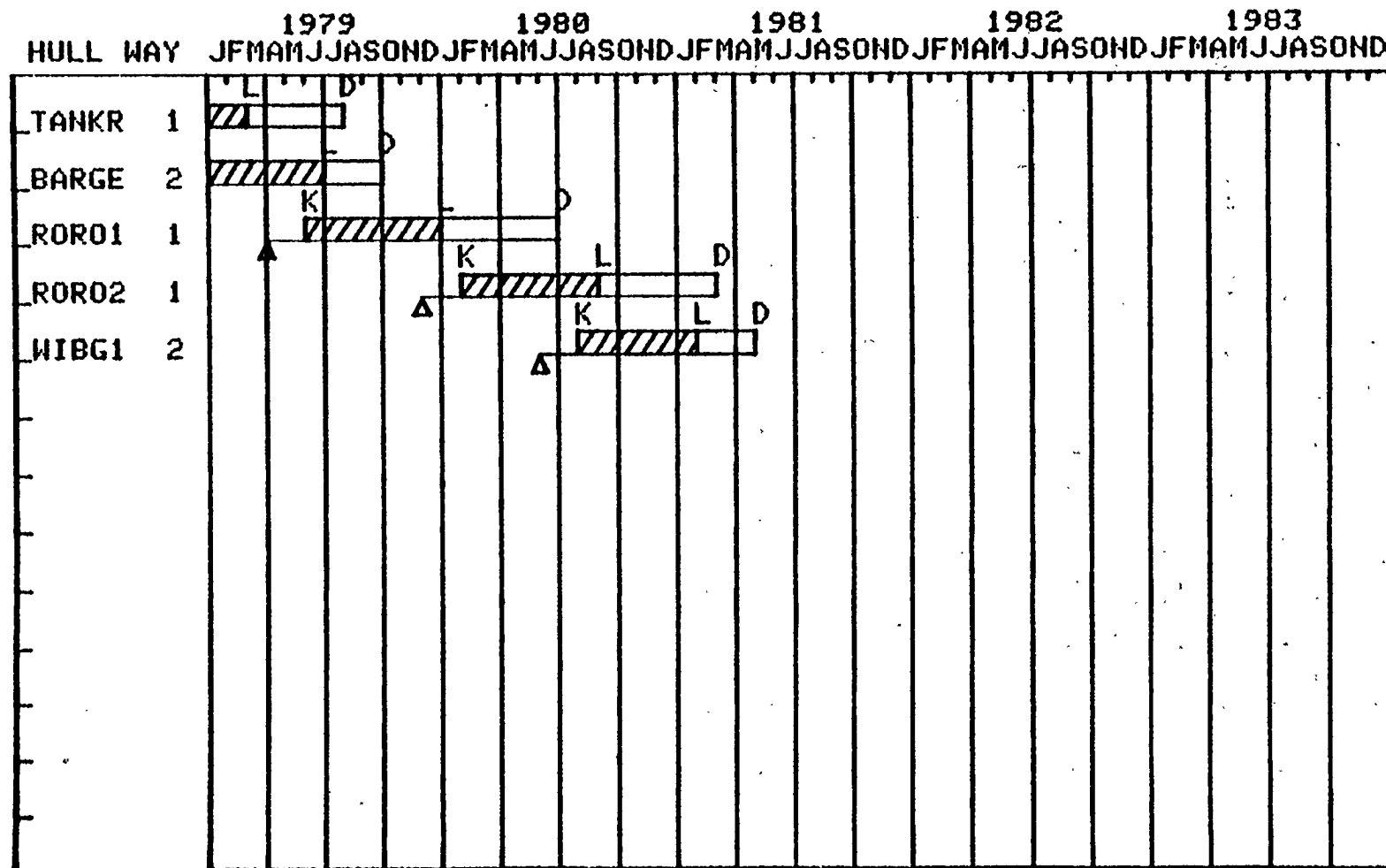



Figure 4.

A B C SHIPBUILDING
AND DRYDOCK CO.

SCHEDULE OF
WAYS UTILIZATION

DATE: 09/11/79
LEGEND:
WAYS 

REAPS PRESENTATION

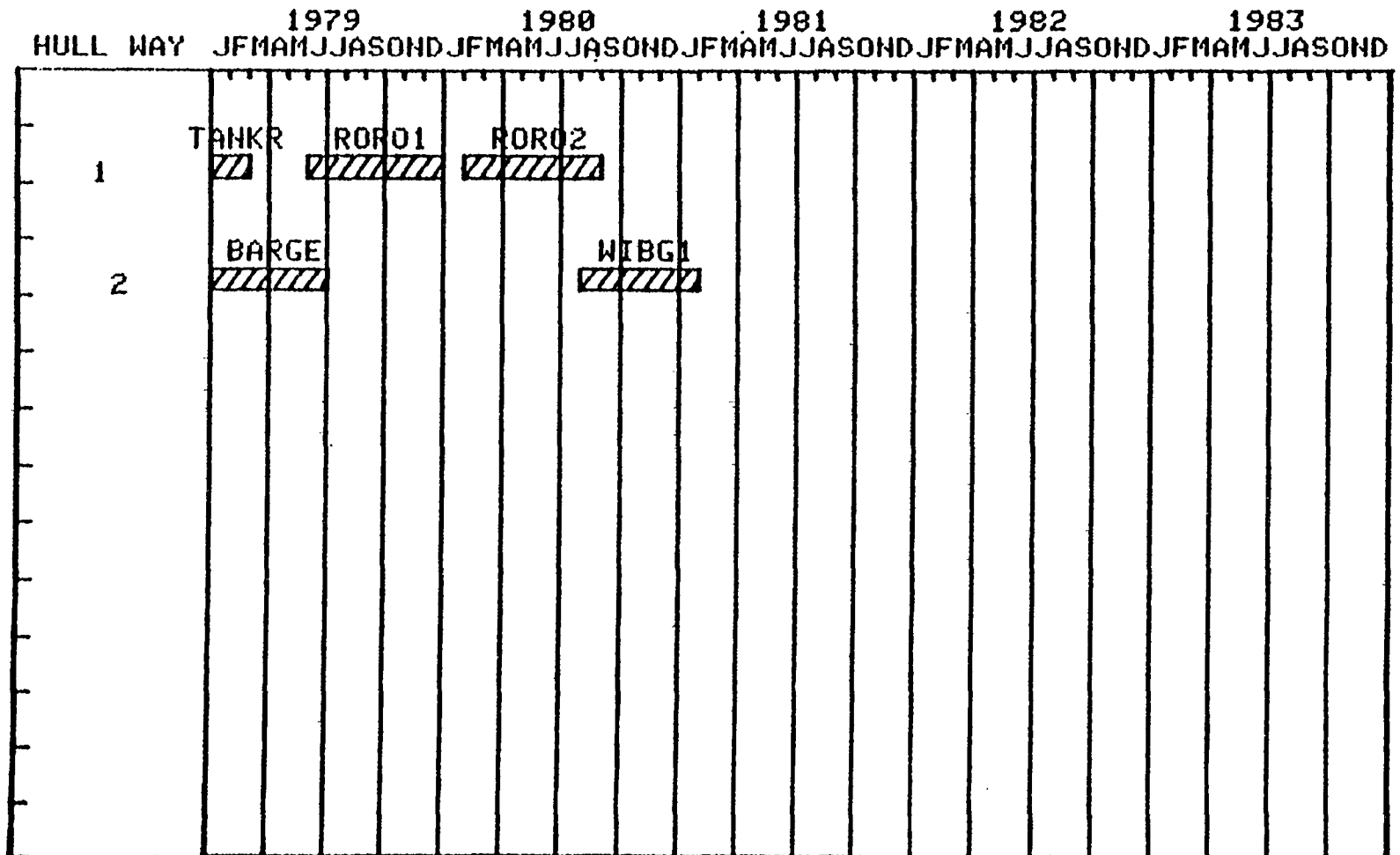


Figure 5.

A B C SHIPBUILDING
AND DRYDOCK CO.

REAPS PRESENTATION

09/11/79

MANLOAD

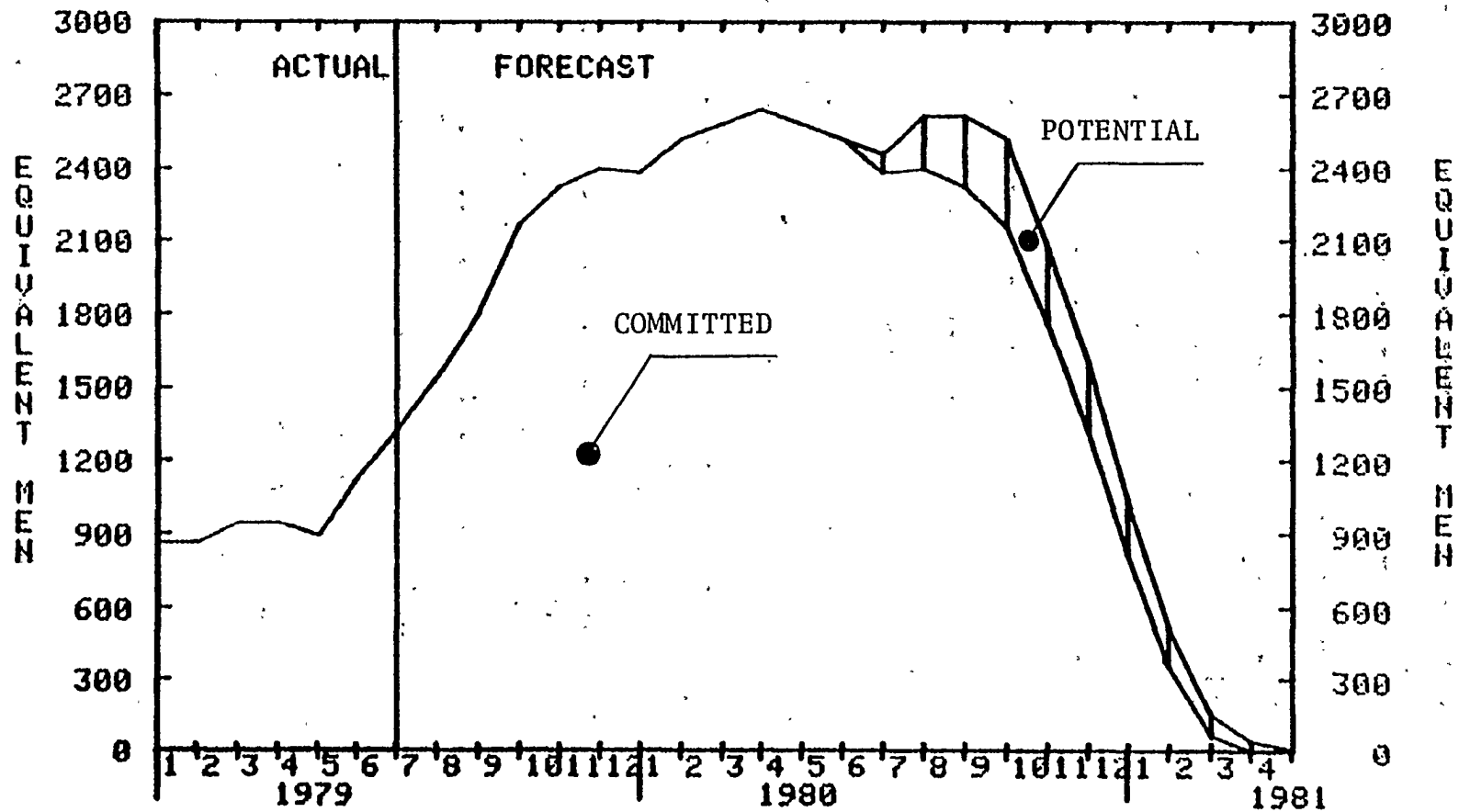


Figure 6.

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